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Preface

Special issue on "Unsaturated soils: Models, algorithms and applications"

Foreword

The development of unsaturated soil mechanics in recent years has progressed at an accelerated rate. The advances made have highlighted the complexity underlying much of unsaturated soil behaviour and the need to develop conceptual frameworks capable of encompassing the description of material behaviour and the capacity for application. The approaches required need to span a wide range of subjects: selection of stress variables, mechanical and hydraulic constitutive models, coupled formulations, implementation algorithms, incorporation of new environmental variables such as temperature, and applications. This special issue contains a number of recent key developments in those topics by leading researchers in the field.

Eight papers are included in this publication. The paper by *Sheng et al.* provides an overview covering several of the themes addressed in this special issue. Key aspects of constitutive modelling are dealt with by *Gallipoli et al.* concerning the appropriate stress variable to represent capillary effects and by *Nuth & Laloui* regarding the generalised hysteretic behaviour of water content changes. Two more papers on constitutive modelling follow: the first one, by *Sun et al.*, tackles the problem of predicting the undrained behaviour of an unsaturated soil and the second one, by *Yang et al.*, proposes an elastoplastic-damage constitutive law for cemented loess under cyclic loading.

Numerical implementation is the main topic of the paper by *Sánchez et al.* It is applied to a double-structure constitutive model for expansive clays, and it is developed in a multi-mechanism framework. The final two papers describe comprehensive formulations for the performance of fully coupled analysis involving unsaturated soils. The one by *Khalili et al.* pays special attention to the questions of hydraulic and mechanical hystereses through the definition of appropriate coupled constitutive models. The paper by *Gatmiri and Arson* describes a thermo-hydro-mechanical formulation starting from the basic balance and constitutive equations, through discretization and algorithm aspects, to applications. In addition, several other papers report examples of applications, from the reproduction of laboratory tests to the numerical analysis of a number of boundary value problems.

In summary, this special issue provides a wide-ranging picture of the present state of advanced research in the field of unsaturated Soil Mechanics. We expect that it will prove a useful resource for academics, researchers and practitioners interested in the current development of the subject and in the likely direction of future progress.

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